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Original Article

Effect of Cage Floor Type on Behavior and Performance of Growing Rabbits

[*1]Abdelfattah E., [1]Karousa M., [1]Mahmoud E., [1]EL-Laithy S., [2]El-Gendi G. and [3]Eissa N.

[1]Department of Animal Hygiene, Behavior and Management, Faculty of Veterinary Medicine, Benha University, Qalyubia, Moshtohor 13736, Egypt.
[2]Department of Animal Production, Faculty of Agriculture, Benha University, Qalyubia, Moshtohor, Egypt.
[3]Aquatic Diseases Laboratory, National Institute of Oceanography and Fisheries, Egypt.

Abstract

Twenty four New-Zealand White rabbits of both genders (12 males and 12 females), 4 weeks old, with nearly equal body weight at the beginning of the experiment, were randomly allotted to three groups of 8 rabbit each (4 males and 4 females). Three groups were established according to the cage floor type. The first group was raised on wire mesh cage floor throughout the experiment. The second group was raised on plastic hollow mat and the third was on rubber hollow mat. Rabbits were weighed at the beginning of the experiment and at weekly intervals thereafter during the experimental period (7 weeks). Individual body weight and feed consumption throughout the experiment were recorded weekly. Body weight gain, feed conversion ratio, ear and eye lesions, total and differential Leukocytes count were also calculated. The results demonstrated that the cage floor type affected drinking and agonistic behavior but did not affect any other behaviors. Rabbits raised on wire mesh floor showed the highest proportion of agonistic behavior. The cage floor type had no influence on BW, feed consumption, BW gain and feed conversion ratio of growing rabbit during the last three weeks of experiment. The incidence of ear and eye lesions was higher in cages with wire mesh (25%) than cages with plastic and rubber mat floor (12.5%). Wire caged rabbits revealed significant increase in white blood cells and lymphocyte counts. It could be suggested that placing of plastic or rubber mat on wire mesh of rabbit' cages has an important effect on reducing the incidence of ear and eye lesions caused by aggressive behaviors and reducing the effect of stress on the total and differential Leukocytes count, as well as improving their welfare state.

Key words: Behavior, cage floor type, growing rabbit, performance.

[*]Corresponding author: Department of Animal Hygiene, Behavior and Management, Faculty of Veterinary Medicine, Benha University Qalyubia, Moshtohor 13736, Egypt.
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Introduction

Rabbit production for meat is a very important livestock activity in most Mediterranean countries, supplying more than 30% of world production. Besides, rabbits reproduce rapidly, a feature that is attractive and can be capitalized on by the farmer to satisfy any growth in consumer demand (Lazzaroni et al., 2009).

Nowadays animal welfare raises interest world-wide. Housing of the animals in large group is believed to be one of the most important factors of well-being. Wild rabbits live in colonies including several adults and a lot of young rabbits together. In most intensive rabbit farms two or three growing rabbits are housed per cage. Searching for a better housing condition fitting the animal welfare aspects is the aim of several researchers. The well-being of the rabbits is affected by the cage floor type of their cages. Because the rabbits spend most of time resting on the cage floor, it is one of the most important factors determining animal welfare (Szendrõ and Luzi, 2006, and Verga et al., 2006).

In large rabbit farms, cages are made almost exclusively from wire net. The wire net cage floor is cheap, easy to clean and it also meets hygienic requirements. However, some authors consider the wire net cage floors unfavorable from the animal welfare viewpoint. Drescher (1992) stated that the rabbits could spend less time with resting on wire net compared to other cage floor types. Behavioral pattern data in the experiment of Trocino et al. (2004) demonstrated that there was no difference between cage floors of wire net or slats with galvanized steel bars, thus indicating a similar degree of body care on both type of cage floors. Preference tests showed that more growing rabbits choose the plastic net but with the increasing age or/and weight they accept the wire net and plastic slat cage floor as well (Matics et al., 2007). Plastic has low thermal conductivity therefore it may give a sensation of warmth, so rabbits prefer staying on plastic. In addition, plastic could reduce foot pad injuries. On the other hand, rabbits could chew plastic cage floors and the risk of coccidiosis is high due to the rapid built up of moisture and feces (Princz et al., 2009). In addition to the positive effect of different cage floor type on behavior in some cases, it is also positively influenced the performance, carcass traits and meat quality (Maertens et al., 2004).

To meet the changing demands of consumers in obtaining rabbit meat from animals reared in environments in accordance with their welfare and to satisfy the expectation of animal welfare, researchers have studied the effect of several alternative management methods on performance and behavior of rabbits. Concerning the effect of cage floor type on rabbit behavior and production only a few papers have been published. The object of this experiment was to study the effect of cage floor type (wire mesh, plastic and rubber mat) on different behavioral patterns, productive performance and total, differential Leukocytes count of growing rabbits.

Materials and Methods

Animals and Experimental Design

The present work was carried out at Rabbit Farm, Animal Production Department, Faculty of Agriculture, University, Moshtohor, Egypt. The experimental period was extended for 7 weeks from March to June, 2010.

A total number of 24 New Zealand White rabbit of both sex (12 males and 12 females), four weeks age were used in the current study, they were marked by ear tattooing and divided into three treatments groups of 8 animal each (4 males and 4 females). The average initial live BW was (562 ±16.75). From weaning age (4 weeks age) until the end of experiment the rabbits were reared in cages of equal size with identical rearing programs under similar environmental conditions except for the cage floor type. **Group1:** rabbits were reared on wire net cage floor throughout the experiment, the wire net cage floor made from galvanized wire with 15×25mm and 3mm wire diameter. **Group 2:** rabbits were reared on a plastic hollow mat made from plastic net element with holes of 15×25mm in size. **Group 3:** rabbits were reared on rubber hollow mat made from rubber element with holes of 15×25mm in size. Before weaning all rabbits were kept in the cages of does on wire net cage floor. The rabbits (n=24) were housed in galvanized cages (53 × 53 35 cm) with a basic area of 0.28 m^2 and

stocking density of 2 rabbits/cage, according to recommendation of (Patrick et al., 1994). The average environmental temperature and relative humidity % during the experimental period were 24 ±0.56 °c and 52 ± 1.30% respectively, were measured daily by using digital thermohygrometer. The rabbits were maintained on a light: dark cycle of 16L: 8D by the natural day light and a 60 watt fluorescent lamb located centrally on 2.20 m height. Water was available ad-libitum from stainless steel nipple drinkers. The rabbits were fed ad-libitum a commercial balanced pelleted ration purchased from Private Company with labeled ingredients: yellow maize, corn gluten, soybean meal, hay, barley, linseed cake, wheat bran, limestone, sodium chloride, vitamins, mineral mixtures and molasses. The ration contained the following nutrients as shown by the factory label:

Crude protein……18.5%
Crude fiber……11.2%
Fat…….2.8%
ME……2600 kcal/kg

Every 1kg of ration contains the following vitamins and minerals: Vitamin A – 12000 IU; vitamin D3 – 900 IU; vitamin E- 50 mg; vitamin k3 – 2 mg; vitamin B1 – 2 mg; vitamin B2 – 6 mg; vitamin B6 – 2 mg; vitamin B12 – 0.01 mg; Biotin – 0.2mg; pantothenic – 20 mg; niacin – 50 mg; folic acid – 5 mg; manganese – 8.5 mg; Zinc – 70 mg; iron – 75 mg; Copper – 5 mg; Iodine – 0.75 mg; Selenium – 0.1 mg.

All the rabbits were medicated from the weaning age until end of experiment as follow:

- Mixture of Doxycycline and Amprolium powder at dose 1 gm/ 1 liter drinking water for the first 5 days after weaning as prevention against pasteurellosis and coccidiosis, then added monthly to drinking water for 5 days.

- Vitamins AD_3E and mineral mixture were added to drinking water 1ml /liter twice per week to raise the flock vitality throughout the experimental period.

- Ivermectine 0.1 ml / kg live BW was injected s/c every month against internal and external parasites.

- At age of 2 months rabbits were vaccinated against viral hemorrhagic diseases by 0.5 ml (S/C) inactivated vaccine.

Data collection

Behavior observation

The behavioral observation was performed according to the recommendation of Paul and Patrick (2007). Rabbits were observed three times daily, at early morning (from 0800 to 0900 h.), early afternoon (from 1200 to 1300 h) and late afternoon (from 1600 to 1700 h) for three days weekly to obtain three daily observation periods for each group. The group was observed for 10 minutes each period (5 minutes for recording feeding, drinking, resting and behaviors and another 5 minutes for recording body care, social, investigatory and agonistic behaviors) using 30 second instantaneous scan sampling method for recording the average number of animals observed to be in the act of pattern (Table 1).

Productive performance

During the experiment the BW and feed consumption were recorded weekly. Body weight gain and feed conversion were calculated from the data of BW and feed intake. The number of ear and eye lesions was recorded in every rabbit at end of experiment (11 weeks age) and represented as percentage.

Total and Differential Blood cell counts

Blood samples were collected from the marginal ear vein from rabbits of each experimental group at the end of experimental period (at 11 weeks of age) in test tubes containing anticoagulant EDTA. Within 1 h of blood sampling, thin blood smears were prepared from each sample on a grease-free glass slide for differential WBC counting. Total Leukocyte count was measured by using a hemocytometer and differential Leukocyte count was performed manually by the microscopical examination of blood films stained by Giemsa stain and examined under oil immersion lens. Absolute counts of different Leukocyte cells were calculated by multiplying the total Leukocyte count by the percentage of each Leukocyte type according to Feldman et al. (2000).

Statistical Analysis

Data were analyzed using SAS software (version, 1999; SAS Institute Inc., Cary, NC). Data were tested for normality before analysis by examination of box and normal distribution plots. The calculation of analysis of variance was carried using ANOVA procedure. Means were compared by the Duncan multiple comparison.

Results and Discussion

Effect of cage floor type on behavior

A comparison of behaviors of rabbits reared on cages with wire mesh, plastic mat and rubber mat floor is presented in Table (2). The proportion of feeding and drinking of rabbits reared on wire mesh, plastic mat and rubber mat cage floor were (0.36 ± .05, 0.11 ± 0.02), (0.33 ± 0.05, 0.10 ± 0.02) and (0.29 ± 0.05, 0.02 ± 0.02), respectively. In cages with rubber mat floor, the number of rabbits performed feeding and drinking was lower than those reared in cages with wire or plastic mat floor. Additionally the proportion of rabbits feeding behavior was increased continuously with advancing in age until week 8, and then gradually decreased ($P \leq 0.05$). The proportion of feeding and drinking of rabbits during the early morning, early afternoon and late afternoon periods were (0.32 ± 0.06, 0.32 ± 0.06), (0.26 ± 0.06, 0.06 ± 0.02) and (0.40 ± 0.06, 0.13 ± 0.02), respectively. The number of rabbits engaged in drinking behavior was significantly ($P \leq 0.05$) higher during late afternoon period. These results are similar to results obtained by Prudhon et al. (1975) who found that the major feed and water consumption of rabbits occur at the late afternoon periods.

Placing rubber or plastic mat on wire mesh had no significant effect on resting behavior ($P > 0.05$; Table 2). The number of animals showed resting behavior reared on wire mesh, plastic mat and rubber mat were 2.91 ± 0.08, 2.96 ± 0.08 and 3.09 ± 0.08 respectively. The number of rabbits resting was significantly affected by age and period of the day. Most rabbits engaged in resting behavior during early afternoon, this may be due to the increase of environmental temperature in the afternoon.

Locomotion was not affected significantly by the cage floor type (Table 3), which mean that placing of rubber or plastic mat on the wire mesh cage floor did not change the rabbit's activity. It was observed that age had a highly significant effect on locomotor behavior ($P \leq 0.001$). The highest activity of the rabbits was during the first week of the experiment protocol because of the new environment. The number of rabbits exhibiting locomotor behavior during the early morning, early afternoon and late afternoon periods was 0.84 ± 0.06, 0.46 ± 0.06 and 0.51 ± 0.06, respectively. Locomotion was significantly higher ($P \leq 0.001$) during early morning period. These results are similar to results obtained by Jekkel et al. (2008) who found that the frequency of locomotion was not affected by the cage floor type and observed the greatest activity of the rabbits during the first week of the experiment and it decreased thereafter varying between 3.80 and 4.71%.

Grooming was not affected by the cage floor type (Table 2), thus indicating a similar degree of comfort on the different three types of cage floor; these data were supported by (Princz et al., 2007). The mean number of rabbits showed grooming was significantly ($P = 0.001$) increased during the first two weeks of the experiment and declined during the last week of the experiment. Periods of day had no effect on grooming. The average number of rabbits performed social behavior in groups of wire mesh, plastic and rubber mat floor were (0.05 ± 0.01, 0.03 ± 0.01, and 0.02 ± 0.01, respectively); social behavior was not affected by the cage floor type. These results are in agreement with results obtained by Jekkel et al. (2008) who mentioned that changing the cage floor type from wire net to deep litter did not affect the frequency of social behaviors.

The number of rabbits performed aggressive behavior increased significantly ($P \leq 0.05$) in cages with wire mesh floor (0.004 ± 0.00) than those reared in cages with plastic and rubber mat floor (0.001± 0.00 and 0.001± 0.00, respectively) as shown in Table (2). So it was clear that plastic and rubber mat floor reduce the aggression between rabbits which could be reflected on productive performance of rabbits. Most of aggressive behavior observed more during the last two weeks of experiment than other weeks but the difference was not significant (Table 2). Period of day had a

significant effect ($P \leq 0.05$) on aggressive behavior; aggressive behavior was greater during the early morning period (from 0800 to 0900 h) than other periods.

Investigatory behavior with its different forms (chin rubbing, licking the wire, gnawing the wire, gnawing the plastic and rubber mat, digging the cage floor, smelling and sniffing) was not affected by the cage floor type (Table 2). The average number of rabbits showed investigatory behavior was greater during the first week of the experiment (mean ± SEM = 0.27 ± 0.04; P = 0.05); perhaps because the exploration of the novel environment. Period of day had a highly significant effect ($P \leq$ 0.001) on investigatory behavior; the mean number of rabbits showed investigatory behavior was higher during early morning period (mean ± SEM = 0.28 ± 0.02) than other periods (0.14 ± 0.02 and 0.13 ± 0.02 respectively). These results may be attributed to the higher activity of rabbits during early morning in order to obtain food or territory and investigation of the cage. From our results it is clear that the cage floor type (wire mesh, plastic and rubber mat cage floor) did not affect any behaviors except for drinking and aggressive behavior. Our results agree with results obtained by Jekkel et al. (2008); Orova et al (2004) and Trocino et al. (2004) who found that the behavior of rabbits was not affected by the cage floor type.

Effect of cage floor type on performance of growing rabbits

The BW at 11 weeks of age (time of slaughtering) for rabbits reared in cages with wire mesh, plastic mat and rubber mat floor were 779.00 ± 12.01, 739.50 ± 12.01and 813.25± 12.01g, respectively. So, the cage floor type had no significant effect on the BW of growing rabbits at the time of slaughtering. Although the BW of rabbits reared on rubber mat cage floor higher than other rabbits, but the difference is not significant. According to several authors (Princz et al., 2009; Princz et al., 2008 and Trocino et al., 2004) the cage floor type had no significant effect on the BW.

The obtained results showed that the ADG (at 6-7 weeks of age) for rabbits reared in cages with wire mesh floor was significantly higher than those reared in cages with plastic and rubber mat floor. While the BW gain (at 7-8 weeks of age) was significantly higher in rabbits on rubber mat floor than others. Daily weight gain between 9 and 11 weeks of age was similar in the three groups. These results were similar to that obtained by Princz et al. (2008) who found that the cage floor type had no significant effect on ADG. With regard to feed consumption; the results showed that the feed intake at 5 to 8 weeks of age was significantly higher in rabbits reared in cages with wire mesh floor than other types of cage floor, while between weeks 9 - 11 the feed intake was similar in the three groups. In age of 7 to 8 weeks, the feed intake of rabbits was greater in groups of wire and rubber floor than the groups of plastic floor. No differences were observed among the three groups in feed conversion efficiency throughout the experimental period. In the present work the cage floor type had no effect on productive performance of growing rabbits at the time of slaughtering (from 9 to 11 weeks of age), These results confirm the finding of Trocino et al. (2004) and Princz et al. (2009) who found that cage floor type had no effect on productive and carcass traits of rabbit.

Ear and Eye Lesions

The treatment had a significant effect ($P \leq$ 0.05, Table 4) on ear and eye lesions; the incidence of ear and eye lesions were greater in cages with wire mesh (25%) than cages with plastic and rubber mat floor (12.5%).So, the enrichment of cages with plastic and rubber floor reduced the percentage of ear and eye lesions caused by aggressive behaviors, as determined at the age of 11 weeks. Eye and ear lesions started to appear at the end of fattening period which may attributed to the marked increase in aggressive behavior. So placing the plastic and rubber mat on the floor of cages may have advantageous effect on welfare of rabbits which need further investigation.

Total and Differential Leukocyte Count

The data of total and differential Leukocyte counts of different experimental groups at the age of 11 weeks were demonstrated in Figure 1; compared to groups of rabbit reared on wire mesh cage floor (as control groups), the leuckogram of group of rabbit reared on plastic mat cage floor was revealed

significant decrease in white blood cells without significant change in the lymphocytes and neutrophils count. In comparison to the data of group of rabbits reared on wire mesh cage floor, the white blood cells and lymphocytes count of rabbits reared on rubber mat cage floor showed significant decrease, without significant change in number of neutrophils. Also it was found a significant decrease in total Leukocyte and lymphocyte counts when compared with group of rabbits reared on plastic mat cage floor.

Table 1: Description of the recorded behavioral patterns.

Behaviors	Description
Feeding	Consumption of feed from the feeder, gnawing the pellet
Drinking	Mouth in contact with nipple drinker
Resting	Sleeping, lying at any position (unsleeping and stretched) and sitting
Locomotion	Any voluntary change of position (treading and running)
Grooming	Any behavior form connected with the own body of the animal (licking and scratching)
Social	The behavior forms described at the grooming conducted on other rabbits (marking each other with the chin)
Investigatory	Behavior forms connected to the cage or its equipments (rubbing, licking, gnawing, smelling and marking with the chin)
Aggressive	All aggressive interactions (i.e. biting, fighting and chasing each other)

Table 2: Least square means and standard errors ($\bar{X}$ ± SEM) for behaviors of growing rabbits as affected by studied factors.

	Mean number of rabbits expressing the behavior/wk (X ±S.E)							
	Feeding	Drinking	Resting	Locomotor	Grooming	Social	Agonistic	Investigatory
Floor type								
Wire mesh	0.36±0.05^{a2}	0.11±0.02^{a}	2.91± 0.08^{a}	0.62± 0.06^{a}	0.29± 0.03^{a}	0.05± 0.01^{a}	0.004± 0.00^{a}	0.21± 0.02^{a}
Plastic mat	0.33±0.05^{a}	0.10±0.02^{a}	2.96± 0.08^{a}	0.60± 0.06^{a}	0.30± 0.03^{a}	0.03±0.01^{a}	0.001±0.00^{b}	0.19±0.02^{a}
Rubber mat	0.29± 0.05^{a}	0.02±0.02^{b}	3.09± 0.08^{a}	0.58± 0.06^{a}	0.24±0.03^{a}	0.02±0.01^{a}	0.001±0.00^{b}	0.16±0.02^{a}
Age (A)								
5th week	0.29±0.08^{b}	0.10±0.02^{a}	2.64±0.13^{b}	0.89±0.09^{a}	0.41±0.05^{a}	0.05±0.01^{a}	0.00±0.00^{a}	0.27±0.04^{a}
6th week	0.37±0.08a^{b}	0.06±0.02^{a}	2.73±0.13^{b}	0.83±0.09^{ab}	0.37±0.05^{a}	0.03±0.01^{a}	0.00±0.00^{a}	0.22±0.04^{ab}
7th week	0.57±0.08^{a}	0.07±0.02^{a}	3.03±0.13^{ab}	0.35±0.09^{cd}	0.16±0.05^{b}	0.02±0.01^{a}	0.00±0.00^{a}	0.17±0.04^{ab}
8th week	0.35±0.08^{ab}	0.11±0.02^{a}	3.24±0.13^{a}	0.25±0.09^{d}	0.18±0.05^{b}	0.01±0.01^{a}	0.00±0.00^{a}	0.11±0.04^{b}
9th week	0.16±0.08^{b}	0.05±0.02^{a}	3.22±0.13^{a}	0.50±0.09^{cd}	0.18±0.05^{b}	0.04±0.01^{a}	0.00±0.00^{a}	0.14±0.04^{b}
10th week	0.29±0.08^{b}	0.09±0.02^{a}	2.83±0.13^{ab}	0.78±0.09^{ab}	0.38±0.05^{a}	0.05±0.01^{a}	0.001±0.00^{a}	0.21±0.04^{ab}
11th week	0.15±0.08^{b}	0.03±0.02^{a}	3.24±0.13^{a}	0.59±0.09^{bc}	0.26±0.05^{ab}	0.04±0.01^{a}	0.001±0.00^{a}	0.17±0.04^{ab}
Period (P)[1]								
P_1	0.32±0.06^{a}	0.02±0.02^{b}	2.86±0.08^{b}	0.84±0.06^{a}	0.32±0.03^{a}	0.04±0.01^{a}	0.004±0.00^{a}	0.28±0.02^{a}
P_2	0.26±0.06^{a}	0.06±0.02^{b}	3.15±0.08^{a}	0.46±0.06^{b}	0.27±0.03^{a}	0.02±0.01^{a}	0.000±0.00^{b}	0.14±0.02^{b}
P_3	0.40±0.06^{a}	0.13±0.02^{a}	2.96±0.08^{ab}	0.51±0.06^{b}	0.24±0.03^{a}	0.04±0.01^{a}	0.000±0.00^{b}	0.13±0.02 ^{b}

[1] Periods within the day: P1 = early morning (from 0800 to 0900 h), P2= early afternoon (from 1200 to 1300 h) P3 = late afternoon (from 1600 to 1700 h).
[2]Means within column with no common superscripts are significantly different.

Monocytes, eosinophils, and basophils count were not affected by treatment. According to Poljicak-Milas et al. (2009) the normal level of the total Leukocyte count in rabbit was 4.2 - 12.3 × 10^3 in male and 4.4 - 12.3 ×10^3 in female rabbit, and normal level of the lymphocytes, neutrophils, monocytes, esinophils and basophils was 16 – 70%, 27 - 94% , 0-3%, 0-2% and 0-1%, respectively. In our study the results within this rang and this absence of any pathological disease or lesion in rabbits throughout the experiment. Stress induced reactions in animals include behavioral and physiological modifications aiming at coping towards the stressor **(**Ludwig et al., 2007). Stress alters the differential white blood cells counts in any species. Physiological studies have shown that

stress can affect the blood cell parameters. These changes include increase in red blood cells, platelets and neutrophil count whereas eosinophils, lymphocytes and monocytes are said to decrease in number Maes et al.(1998) and Thrall (2004). Rabbits are particularly susceptible to the effect of stress.

Table 3: Effect of cage floor type on performance of growing rabbits.

(Age) week	Floor Type		
	Wire-mish	**Plastic-mat**	**Rubber-mat**
	BW (g)		
5	779.00 ± 12.01[a]	739.50 ± 12.21[a]	813.25 ± 12.01[a]
6	1060.62 ± 23.38 [a]	975.88 ± 23.38 [b]	1026.63 ±23.38 [ab]
7	1206.88 ± 36.18 [ab]	1110.37 ± 36.18 [b]	1236 ± 36.18[a]
8	1470.50 ± 50.93[ab]	1365.75 ± 50.93 [b]	1546.50 ± 50.93[a]
9	1719.92 ± 59.97 [a]	1657.87 ± 59.97 [a]	1835.75 ± 59.97 [a]
10	1893.00 ± 61.37 [a]	1846.62 ± 61.37[a]	2033.12 ± 61.37 [a]
	Daily weight gain (g/day)		
5-6	33.00 ± 1.63 [a]	29.00 ±1.63 [a]	31.00±1.632 [a]
6-7	40.00 ±2.23 [a]	34.00 ±2.23 [ab]	30.00 ± 2.23[b]
7-8	21.00 ±1.63 [b]	19.00 ±1.63 [b]	30.00±1.63 [a]
8-9	38.00 ± 2.00 [a]	38.00 ±2.00 [a]	44.00±2.00 [a]
9-10	36.00 ±1.63 [a]	36.00 ±1.63[a]	41.00±1.63 [a]
10-11	25.00 ±2.23 [a]	29.00±2.23[a]	28.00±2.23 [a]
	Feed intake (g/day)		
5-6	111.00 ± 1.63 [a]	87.00 ± 1.63 [c]	99.00 ±1.632 [b]
6-7	91.00 ± 1.15 [a]	77.00 ± 1.15 [c]	87.00 ±1.154 [b]
7-8	134.00 ± 2.00 [a]	101.00 ± 2.00 [b]	130.00 ±2.000 [a]
8-9	132.00 ± 2.00 [a]	132.00 ±2.00 [a]	139.00±2.00 [a]
9-10	134.00 ± 1.79 [a]	133.00 ±1.79 [a]	134.00±1.79 [a]
10-11	142.00 ± 1.63 [a]	141.00 ±1.63 [a]	142.00±1.63 [a]
	Feed conversion (g/g)		
5-6	3.36 ± 0.57 [a]	3.02 ± 0.57 [a]	3.20 ± 0.57 [a]
6-7	2.25 ± 0.57 [a]	2.27 ± 0.57 [a]	2.84 ± 0.57 [a]
7-8	6.41 ± 1.15 [a]	5.26 ± 1.15[a]	4.33 ± 1.15[a]
8-9	3.51 ± 1.10 [a]	3.68 ± 1.10 [a]	3.14 ± 1.10 [a]
9-10	3.77 ± 1.00 [a]	3.65 ± 1.00 [a]	3.25 ± 1.00 [a]
10-11	5.25 ± 1.15 [a]	3.38 ±1.15 [a]	5.03 ± 1.15 [a]

Means within a raw with similar superscripts are not different ($P \geq 0.05$).

In our study the evaluation of leukogram in the rabbits reared on plastic and rubber mat cage floor revealed significant decrease in total Leukocytes and lymphocyte counts without significant changes in neutrophlis count, when compared the data of these groups with the data of rabbits reared on wire mesh cage floor. The use of plastic and rubber matting reduce the effect of stress on peripheral

mononuclear cells. We would say that wire caged rabbits have increased white blood cells and lymphocytes count as a result of chronic stress. On the same line, these data were supported by O'Driscoll et al (2009); Gupta et al.,(2007) and Cook,(2003) who found that concrete cage floor is one of common chronic stressors which result in more circulating peripheral mononuclear cells in dairy cattle and use of rubber matting reduce effect of chronic stress on total and differential Leukocyte count, and these results were appeared in behaviors of rabbits (significantly reduce the frequency of ear and eye lesions caused by aggressive behaviors).

Table 4: Percentage of injured growing rabbit affected by different cage floor type.

	Cage Floor Type (F)		
	Wire mesh	**Plastic mat**	**Rubber mat**
Number of rabbit a live at 11 weeks of age	8[a]	8[a]	8[a]
Injured rabbits, %	25[a]	12.5[b]	12.5[b]

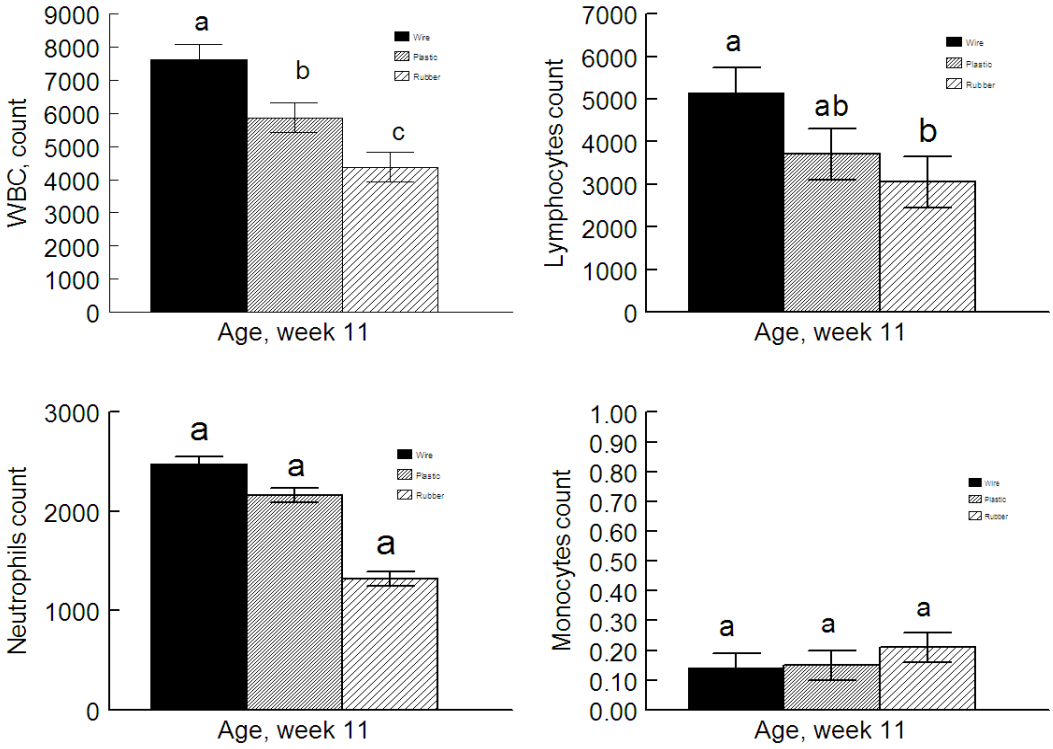

Fig. 1: The effect of cage floor type on total and differential Leukocyte counts at the age of 11 weeks, (a, b differences are significant at $P \geq 0.05$).

Conclusion

The use of plastic or rubber mat on wire cage floor affected drinking and agonistic behavior but did not affect any other behaviors and productive performance of growing rabbits during the last three weeks of experiment, but in the same time reduce the incidence of ear and eye lesions caused by aggressive behaviors and reduced the effect of chronic stress on total and differential Leukocytes count of rabbits. So that, plastic and rubber cage floor are advantageous from the viewpoint of animal welfare.

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